CS-1720

20 MHz DUAL TRACE

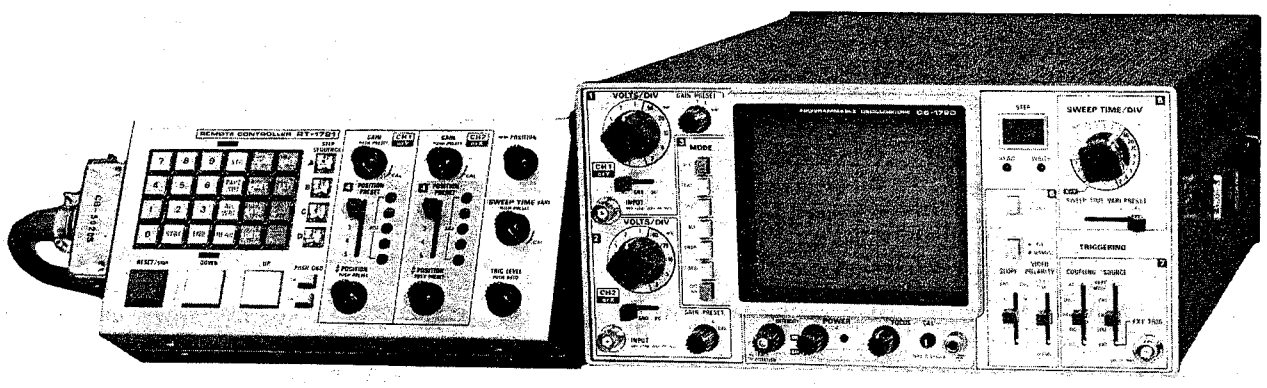
PROGRAMMABLE OSCILLOSCOPE

OPTION

RT-1721

REMOTE CONTROLLER

INSTRUCTION MANUAL



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GENERAL INTRODUCTION

The CS-1720 is a dual-trace programmable oscilloscope, with up to 62 main programme functions settings programmable beforehand. With such prior programming, great energy savings are possible in the manufacturing process, as the oscilloscope can be operated with simple key controls. In addition to the programmed operation, it is possible to use the CS-1720 as a normal manually controlled scope by switching it over to the FREE position. The function of the oscilloscope is further increased with optional accessory units: the probe selector, which gives 20 possible signal channels; the memory pack, which can transfer and retain the programme contents; and the printer which can produce a hard copy of the programme data. Remote control test fixture of the production line, and computer control are also possible.

FEATURES

- The microprocessor: programmes with a maximum of 62 steps can be stored in the oscilloscope memory.
- Programming and waveform measuring conditions are easily programmed by panel control with one-touch key operations.
- Parts of the programme can be easily corrected using the clearly laid out function control panel.
- A maximum of 62 steps (00-61) can be directly set with the key board, and sequentially set with the UP/DOWN keys.
- The programme contents have a battery powered back-up system, and are able to be retained in the memory for a long time, even though the POWER switch is off.
- One-touch operation converts the oscilloscope to manual control, when it functions as a normal oscilloscope.
- Presetting of four start (A, B, C, D) and stop steps is possible, so only one-touch operation is necessary to change steps.
- 2 mV/div and 20 MHz gives an oscilloscope of high sensitivity, with a wide bandwidth, and at the same time light and compact.
- The 140 mm rectangular CRT has internal graticule with 8 × 10 divisions, post deflection acceleration, and high trace intensity.
- Vertical and horizontal positioning, variable gain and trig level by remote operation are possible
- As push GND remote operation is possible on CH1 and CH2, the reference level can be easily and accurately calibrated at hand.
- VIDEO FRAME/LINE sync circuit permits to observe both easy and stable VIDEO signal.
- Observation of VIDEO signal in different fields can be carried out simultaneously using the one input signal, dual trace by SEP function.
- CH1/CH2 independent TRIG SLOPE system is provided.
- As CH1 monitor output can be achieved, a frequency counter or similar instrument can be easily connected.
- Memory back-up, down-warning system is provided.

OPTIONAL ACCESSORIES

- By using the probe selector, either 5 types of input signal change-over (RU-1722) per channel, or 10 types (RU-1723) can be programmed.
- By using the thermal printer (TP-1724), a hard copy of the programme contents can be made.
- By using the memory pack (MT-1725), the programme contents for up to 62 steps can be transferred from the oscilloscope to the memory pack or vice versa, and the data can be retained for a long period of time.
- SWEET OUT and SWEEP GATE output terminals are optional.
- The interface unit of the external control unit can be matched.

SPECIFICATIONS

CS-1720 PROGRAMMABLE OSCILLOSCOPE

CATHODE RAY TUBE (CRT)

Model	140CGB31
Type	Rectangular with internal graticule.
Acceleration voltage	6 kV
Display area	8 × 10 divisions (1 div = 9.5 mm)

VERTICAL AXIS (CH1, CH2,)

Sensitivity	2 mV/div — 5 V/div
Accuracy	± 5%
Attenuator	2 mV/div — 5 V/div 1-2-5 sequence. Fine adjustment possible between all ranges; remote controller (RT-1721), CAL and 4 range presets with vernier adjustment are possible.
Input resistance	1 MΩ ± 5%
Input capacity	37 pF ± 3 pF
Input coupling	AC-GND-DC
Frequency response	
DC	DC — 20 MHz (− 3 dB) DC — 30 MHz (− 6 dB)
AC	5 Hz — 20 MHz (− 3 dB) 5 Hz — 30 MHz (− 6 dB)
Risetime	Better than 17.5 ns
Signal delay time	More than 10 ns on the screen.
Crosstalk	− 40 dB or better, at 1 kHz
Operating modes	
CH1	CH1 only, single trace
CH2	CH2 only, single trace
ALT	CH1, CH2 dual trace, alternate mode
CHOP	CH1, CH2 dual trace, chop mode
ADD	Single trace algebraic sum of CH1 and CH2
CH2 INV	CH2 inverted polarity, CH1 minus CH2, single trace
SEP	CH1 or CH2, one input signal, dual trace, alternate
Chop frequency	Approx 200 kHz
Maximum input voltages	200 V p-p or 100 V (DC + AC peak)
Maximum undistorted amplitude	8 div. minimum from DC — 20 MHz

HORIZONTAL AXIS (CH2 INPUT)

Operating modes	SWEEP TIME/DIV range can be selected to X — Y mode. CH1 — Y axis: CH2 — X axis
Sensitivity	Same as CH2 vertical axis
Accuracy	Same as CH2 vertical axis
Attenuation	Same as CH2 vertical axis
Input resistance	Same as CH2 vertical axis
Input capacity	Same as CH2 vertical axis
Input coupling	Same as CH2 vertical axis
Frequency response	
DC:	DC — 2 MHz (− 3 dB)
AC:	5 Hz — 2 MHz (− 3 dB)
X — Y phase difference	Within 3° at 100 kHz

SWEEP CIRCUITS

Sweep system	
NORM	Triggering sweep (remote controller RT-1721)
AUTO	Triggering sweep and auto free run sweep in absence of trigger signal (with RT-1721)
Sweep time	0.2 μs/div — 0.5s/div 1-2-5 sequence, with vernier control fine adjustment between all 20 ranges (with remote controller RT-1721); CAL and 3 range presets with vernier adjustment are possible.
Accuracy	± 5%
Sweep magnification	X5 (five times) ± 5%
Linearity	3% or better at normal, 5% or better at X5 magnification

TRIGGERING

Source	VERT MODE, CH1, CH2, LINE, EXT.
Coupling mode	AC, LFREJ, HFREJ, DC, VIDEO.
Video polarity	VIDEO (+/−); FRAME (+/−)
Triggering mode	MANUAL, FIX (automatically fixes level at center of trigger source).
Sync polarity	CH1/CH2 (+/+, +/−, −/+, −/−)
External sync	EXT
Input resistance	1 MΩ ± 5%
Input capacity	40 pF ± 5 pF
Maximum input voltage	100 Vp-p, or 50 V (DC + AC peak)

Trigger sensitivity

Coupling	Frequency range (Hz)	Minimum Sync Voltage	
		INT	EXT
AC	10 ~ 20 MHz 20 ~ 15 MHz	1 div. 0.5 div.	1.0 V 0.5 V
AC (LFREJ)	Below 30 kHz the minimum sync amplitude (voltage) will increase.		
AC (HFREJ)	The range below 20 Hz and above 30 kHz the minimum sync amplitude (voltage) will increase.		
DC	DC — 20 MHz DC — 15 MHz	1 div. 0.5 div.	1.0 V 0.5 V
VIDEO	VIDEO SYNC LEVEL	0.5 div.	0.5 V

AUTO:	Same as above specifications for above 20 Hz
FIX:	20 Hz — 20 MHz, 1 div. (1.0 V)
Calibration voltage	Square wave, positive polarity 0.1 V ±2% 1 kHz ±5%

INTENSITY MODULATION

Input voltage	In TTL level intensity modulation is possible. (More positive levels increase the intensity).
Input impedance	Approx. 10 kΩ
Usable frequency range	DC — 5 MHz
Maximum input voltage	±50 V (DC+AC peak)

VERTICAL AXIS SIGNAL OUTPUT (Signal Output of CH1)

Output voltage	100 mV p-p/div minimum, at 1 kHz
Output impedance	Approx 50 Ω
Frequency response	10 Hz — 20 MHz (−3 dB) (50 Ω load)

SWEEP OUTPUT (Optional)

Output voltage	More than 1 V p-p (50 Ω load)
Output impedance	Approx 50 Ω

GATE OUTPUT (Optional)

Output voltage	TTL output, series resistance 220 Ω negative logic (during sweep operation, low level)

TRACE ROTATION

Trace angle is possible by trace rotation control on the front panel.

PROGRAMME STATES

Programme items	8 blocks, 24 items
1 block (CH1)	
Input coupling	AC/DC
Vertical sensitivity	2 mV/div — 5 V/div (11 ranges) CAL and 4 presets with vernier adjustment are provided.
2 block (CH2)	
Input coupling	AC/DC
Vertical sensitivity	2 mV/div — 5 V/div (11 ranges) CAL and 4 presets with vernier adjustment are provided.
3 block	
Separate	SEP (CH1/CH2)
Operating mode	CH1, CH2, ALT, CHOP, ADD
Polarity inversion	CH2 INV
4 block	
Vertical position	CH1: 5 point presets (more than ±4 div adjustable).
Vertical position	CH2: 5 point presets (more than ±4 div adjustable).
5 block	
Sweep time	0.2 μs/div — 0.5 s/div (20 ranges) CAL and 3 range presets with vernier fine adjustment.
X-Y operation	X-Y, 1 range.
6 block	
Sweep magnification	X5 (five times) MAG
Triggering mode	MANUAL/FIX
Sync polarity	CH1/CH2 (+/+, +/−, −/+, −/−)
VIDEO polarity	VIDEO (+/−); FRAME (+/−)
7 block	
SOURCE	V MODE, CH1, CH2, LINE, EXT
Coupling	AC, LFREJ, HFREJ, DC, VIDEO
EXT trigger input	OFF, 1 2 3 (RU-1722, RU-1723)
8 block	
Input signal changeover (CH1)	1 — 5 (RU-1722) 1 — 10 (RU-1723)
Input signal changeover (CH2)	1 — 5 (RU-1722) 1 — 10 (RU-1723)
Remote	Step sequence: A, B, C, D. Start step, end step, 4 kinds of each.

PROGRAMME CONTROL FUNCTIONS

Control method	Microprocessor control
Memory	CMOS, RAM, with battery
Steps	62 steps (00 — 61)
Operation	Key operation (remote controller RT-1721)
Indication	STEP NO., 2 figures, 7 segments READ: green LED WRITE: red LED PART WRT: green & red LEDs

Protective circuitry	Low battery level indication is provided. (7 segments flash on) Memory pack: misconnection avoidance function is provided (no operation). Printer: misconnection avoidance function is provided: warning alarm will sound.

OPTIONAL EXTERNAL ACCESSORIES

Probe selector, RU-1722 (CH1 × 5 & CH2 × 5, EXT × 3)
Probe selector, RU-1723 (CH1 × 10 or CH2 × 10, EXT × 3)
Thermal printer TP-1724
Memory pack MT-1725
It is possible to expand the function of the oscilloscope with external control.

POWER SUPPLY

Voltage	Low: 90 V — 132 V High: 180 V — 264 V
Frequency	50/60 Hz
Power consumption	Approx 43 W

DIMENSIONS

Width	284 (312) mm
Height	138 (150) mm
Length	400 (450) mm

The dimensions in brackets are including fittings.

WEIGHT 7.1 kg

ACCESSORIES Probes; 2 pieces (PC-39)
Instruction manual; 1 copy.
AC power cable: 1 piece

OPERATING ENVIRONMENT

Optimum temperature and humidity:	10°C — 35°C 85% RH or less
Operating temperature and humidity:	0°C — 50°C, 90% RH or less
Storage temperature and humidity:	−20°C — 55°C, 80% RH or less

OPTIONAL ACCESSORIES

Remote controller; RT-1721
Probe selector, (5 inputs × 2 channel); RU-1722
Probe selector, (10 inputs × 1 channel); RU-1723
Thermal printer; TP-1724
Memory pack: MT-1725

RT-1721 REMOTE CONTROLLER (OPTION)

REMOTE OPERATION SECTION

VERTICAL AXIS (CH1, CH2)

Variable attenuation	Vernier fine adjustment between all ranges of VOLTS/DIV control on CS-1720 is possible, in addition to preset change-over.
Position adjustment	5 Presets, more than ± 4 div. adjustable. Vernier fine adjustment: more than ± 2 div adjustable.
Input coupling	Push GND, CH1/CH2
Horizontal position adjustment	More than ± 5 div adjustable.
Sweep time variable	Vernier fine adjustment between all ranges of SWEEP TIME/DIV control on CS-1720 is possible, in addition to preset change-over.
Sweep mode	NORM/AUTO
Trigger level	More than ± 4 div

PROGRAMME OPERATION SECTION

Programme console keys	29 types.

DIMENSIONS

Width	230 (290) mm
Height	55 (69) mm
Length	115 (120) mm

Dimensions in brackets are with fittings.

WEIGHT 1.2 kg

ACCESSORY Connecting cable CB-5020S

OPERATING ENVIRONMENT

Same as oscilloscope CS-1720

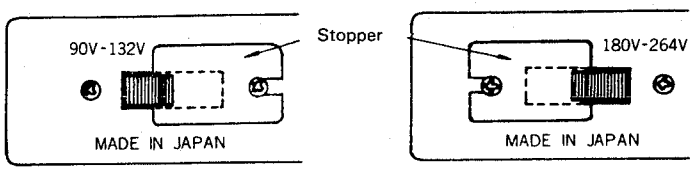
■ Circuit and rating are subject to change without notice due to developments in technology.

PRECAUTIONS

NOTE

Before using the oscilloscope CS-1720, check the power supply voltage, and make sure that the voltage selector switch is correctly set to the corresponding voltage. If the control is incorrectly set, damage to the electric circuits will occur, so check carefully. After checking that the power supply voltage and the voltage selector switch correspond, connect the CS-1720 oscilloscope to a suitable socket using the AC power cord.

1) **Do not switch the power switch on and off rapidly in succession, as this may cause it to malfunction. Allow at least 3 seconds between switching on and switching off.**
2) **When connecting or disconnecting any of the optional accessories, the power must be OFF.**
3) Avoid using the CS-1720 under the following conditions:
   a) In direct sunlight.
   b) In a room with high temperature and humidity.
   c) In a room affected by vibration from nearby machinery.
   d) Near any high voltage instrument, or one with a strong magnetic field.
4) Ensure that the voltage at each input terminal does not exceed the maximum rating.
   CH1, CH2 input: Refer to specifications
   EXT TRIG input: Refer to specifications
   Z AXIS input: Refer to specifications
   Do not connect any of the output terminals to an external signal source.
5) Keep the brightness control to the necessary minimum.
6) Do not leave the CS-1720 for any length of time with a stationary spot displayed on the screen.
7) The CS-1720 uses a backup battery system for the programme data. When the battery level is getting low, the STEP LED will flash when the power is switched on. In this event, replace the batteries, referring to the appropriate section in the maintenance instructions.
8) To avoid possible electric shocks, ensure the earth terminal is properly connected. (See front panel ⏚ (16) for explanation and instructions)
9) Be sure that no objects are allowed to rest on the top of the unit or that cooling vents are not blocked, since this will cause an undue temperature rise.
10) Before removing the case, be sure to turn off the power. Since the CS-1720 makes use of high voltage circuitry, if removing the case, refer to the "MAINTENANCE" for removing the case.
11) Setting the AC voltage selector.

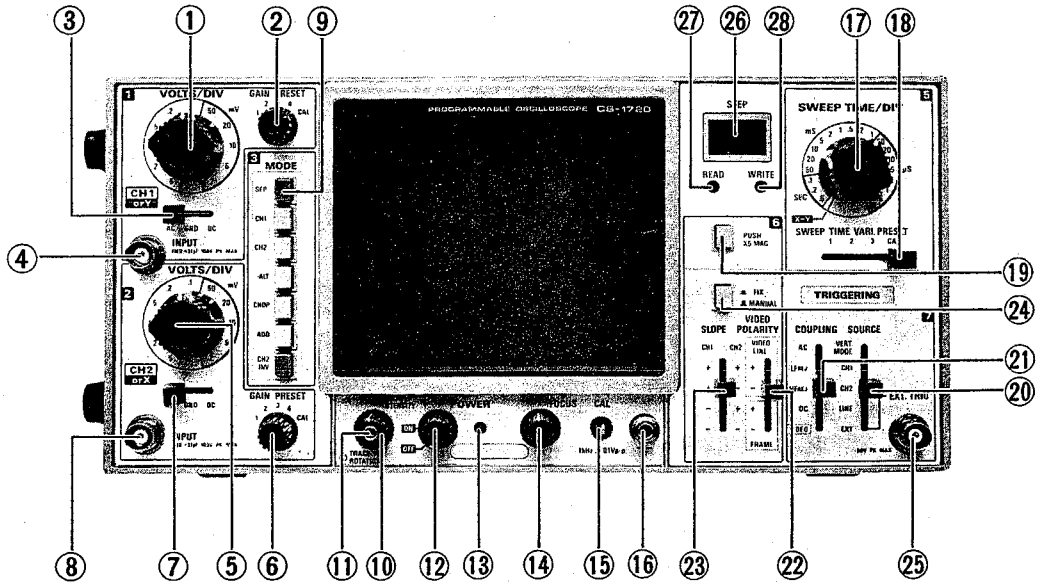


   1) Loosen the screw and remove the stopper plate.
   2) Switch the lever to the opposite side.
   3) Lock the lever by attaching the stopper plate to the opposite side and tight the two screws.
12) Cascade connection must not be made. Never make cascade connection with CH1 output to the CH2 input or EXT input.
13) Never connect CH1 or CH2 input in parallel with EXT input.
14) In order to obtain accurate measurements, it is most important to calibrate the probe correctly before using the oscilloscope. First, connect the probe to the channel to be used, and connect the tip of the probe to the CAL terminal on the front panel. Adjust the probe trimmer pot to get the proper square waveform on the CRT screen. When connecting the probe to the CAL terminal, be sure always to connect it together with the GND terminal. When the GND terminal is in an open condition, signal noise will accompany the waveform.

CONTROLS AND INDICATORS

PROGRAMMABLE OSCILLOSCOPE CS-1720

<FRONT PANEL>



(1) VOLTS/DIV
Vertical attenuator calibrated in voltage per division, in 1-2-5 sequence, and adjustment will give the optimum waveform. The vertical sensitivity is calibrated at GAIN CAL position. When the oscilloscope is being used as an X-Y scope, this control serves as the Y-axis control.

(2) GAIN PRESET
Vertical attenuation adjuster and preset selector; change-over of 4 preset ranges and CAL, set by the vertical attenuation adjustment control (29). This selector is calibrated in the CAL position. In X-Y scope this control is the Y-axis preset selector.

(3) AC-GND-DC
Vertical input selector switch for CH1. In X-Y operation, the Y axis-input selector switch.

AC: The DC component of the input signal is blocked.

GND: Opens signal path and ground input to vetical amplifier. This provides a zero signal base line.

DC: Direct input of both AC and DC components of input signal.

(4) INPUT
Vertical input terminal for CH1. During X-Y operation, the Y-axis input.

(5) VOLTS/DIV
Vertical attenuator for CH2, having the same function as CH1 VOLTS/DIV (1). During X-Y operation, the X-axis attenuator.

(6) GAIN PRESET
CH2 vertical attenuator adjuster and preset selector. Has the same function as CH1 GAIN PRESET (2). In X-Y operation, the X-axis preset attenuation selector.

(7) AC-GND-DC
CH2 vertical input selector. In X-Y operation, the X-axis input selector switch. It has the same function as CH1 AC-GND-DC (3).

(8) INPUT
CH2 vertical input. In X-Y operation, the X-axis input terminal.

(9) MODE
Selects the operating mode of the vertical axis.

CH1: CH1 input signal is displayed on the CRT screen.

CH2: CH2 input signal is displayed on the CRT screen.

ALT: CH1 and CH2 signals are displayed alternately.

CHOP: CH1 and CH2 signals are displayed in chopping mode.

ADD: The algebraic sum of CH1 and CH2 is

displayed, in single trace. When CH2 INV is set, the difference is displayed in single trace.

CH2 INV: The polarity of CH2 signal is reversed.

SEP: CH1 input signal is alternately displayed in both "main" and "sub". Refer to SEPARATE PRESET (30) instructions. In CH2, CH2 input signal is displayed as same function as CH1 SEP operation.

NOTE

The various vertical mode are related to trigger source. Refer to SOURCE (20) instructions.

(10) INTENSITY

Adjusts the brightness of the trace, with outside axis control. Clockwise rotation increases brightness.

(11) TRACE ROTATION

Adjusts the angle of the horizontal trace.

(12) POWER

Switches on or off the power to the CS-1720. When connecting or disconnecting any of the optional accessories be sure the power switch is in the OFF position.

(13) PILOT LAMP

When lit, indicates power is ON.

(14) FOCUS

Adjusts the focus of the trace. As the CS-1720 uses an auto focus circuit, once this control is adjusted, it need not frequently to be readjusted.

(15) CAL

Provides 0.1 V peak to peak square wave input signal at 1 kHz.

(16) ⏚ GND

The ground terminal used to earth the oscilloscope chassis and body as an aid against electrical shocks.

(17) SWEEP TIME/DIV

Horizontal sweep time control. It selects sweep times from 0.2 μs/div — 0.5 s/div in 20 ranges in 1-2-5 sequence. In addition, full counter-clockwise rotation energises X-Y scope operation.

(18) SWEEP TIME VARI PRESET

This control is a fine adjuster and preset for sweep time. It can select three range presets and CAL set by SWEEP TIME VARI PRESET (36). Sweep time is calibrated in CAL position.

(19) PUSH X5 MAG

When this control is pushed in (■) position, the sweep time is made 5 times faster per division. With the button in (▬) position, mormal sweep time is resumed.

(20) SOURCE

Selects sweep trigger source.

VERT MODE: Trigger signal is selected by setting vertical mode.

CH1	CH1 signal becomes trigger source
CH2	CH2 signal becomes trigger source
ALT	For CH1, CH1 signal becomes trigger source For CH2, CH2 signal becomes trigger source.
CHOP	CHOP change-over signal becomes trigger source
ADD	Algebraic sum of CH1 & CH2 signals becomes trigger source

CH1: CH1 signal becomes trigger source.

CH2: CH2 signal becomes trigger source.

LINE: The power source frequency signal becomes trigger source.

EXT: The signal applied to EXT TRIG (25) becomes trigger source.

NOTE

1) When the vertical axis mode is set in ALT, in VIDEO FRAME (22) CH1 signal will be fixed to trigger source.
2) When the vertical axis mode is set in CHOP, as the CHOP change-over signal becomes the trigger source, stable display cannot be observed. Therefore in this instance, select proper trigger signal, excluding VERT MODE.

(21) COUPLING

Controls the coupled trigger signal

AC: Trigger signal is AC coupled, excluding DC components.

LFREJ: Trigger signal is coupled to sync circuit through high pass filter. All low frequency components are attenuated.

HFREJ: Trigger signal is coupled to sync circuit through low pass filter. All high frequency components are attenuated.

DC: Trigger singal is DC coupled, and is coupled to sync circuit, including DC components.

VIDEO: For video sync signal. In this case if VIDEO POLARITY switch (22) is set to VIDEO LINE or FRAME, horizontal sync (TV. H) or vertical sync (TV. V) can be selected for synchronization.

(22) VIDEO POLARITY

Select polarity of video snyc signal.

VIDEO LINE: Sweep is triggered on horizontal sync signal in video signal. At this time, + or − polarity should be selected.

+: For positive polarity sync signal (sync signal is up side of the VIDEO signal)

−: For negative polarity sync signal (sync signal is down side of the VIDEO signal)

VIDEO FRAME: Sweep is triggered on vertical sync signal in VIDEO signal.

+: For positive polarity sync signal (Sync signal is up side of the VIDEO signal)
−: For negative polarity sync signal (Sync signal is down side of the VIDEO signal)

NOTE
As the 1/2 divider circuit is provided in the VIDEO FRAME synchronizing circuit, odd or even field can be selected by the SLOPE (23) selector switch; refer to VIDEO SYNC in OPERATION instruction.

(23) SLOPE
Sync polarity selector switch. Also odd or even field selector when VIDEO FRAME is set.

CH1: CH1 sync polarity change-over.
+: Sweep is triggered on rising slope of waveform.
−: Sweep is triggered on falling slope of waveform.

CH2: CH2 sync polarity change-over.
+: Sweep is triggered on rising slope of waveform.
−: Sweep is triggered on falling slope of waveform.

NOTE
For SLOPE the polarity of CH1 +/− and CH2 +/− is changed over according to the sync signal selected on SOURCE (20). However, since some connections exist with MODE and VIDEO FRAME, refer to the OPERATION instructions.

(24) FIX/MANUAL
FIX (▬): Automatic triggering level control. Sync is obtained without connection with TRIG LEVEL (60).

MANUAL (■): Triggering level can be adjusted by TRIG LEVEL (60).

NOTE
When TRIG LEVEL (60) is pulled out (PULL NORM), FIX operation is automatically cancelled, and manual operation is selected.

(25) EXT TRIG
External trigger input terminal. If SOURCE (20) switch has been set to EXT, the signal at this input becomes the trigger source.

(26) STEP
Programme step number indicator. Step number can be indicated from 00 to 61 as 2 figures of seven segments. When PART WRT is selected numbers from 1 to 8 can be indicated in single figures. This is also used as the battery low level warning indicator which will flash when the internal memory back-up battery is below its operational level.

NOTE
Step numbers from 00 to 99 can be indicated. However, if 62 or over is indicated, the indicator will flash once, and the step will have no effect.

(27) READ
Green LED indicates programme data are being read out. At the time of PART WRT it will light up together with the WRITE LED (28).

(28) WRITE
Red LED indicates input signal is being written in the memory. When PART WRT is set, it will light up together with the READ LED (27).

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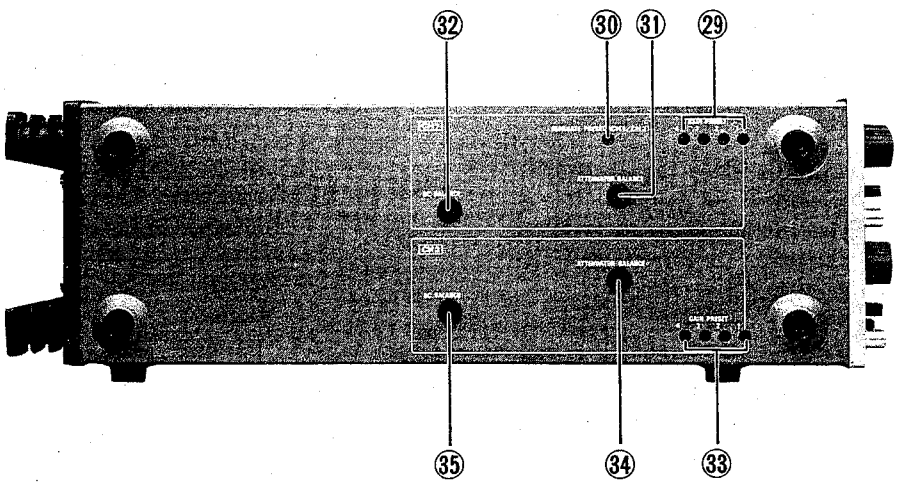

(29) GAIN PRESET
Fine adjustment control CH1 vertical attenuation for preset. 4 preset gains can be set and selected by GAIN PRESET (2).

(30) SEPARATE PRESET (CH1/CH2)
Vertical position adjustment for sub-sweep preset when SEP (9) in vertical axis mode is selected. Preset adjustment is possible within ±4 div from the main

vertical sweep position. The preset distance will not change despite changing ▲▼ POSITION controls (52/53, 55/56).

(31) ATTENUATOR BALANCE
Vertical DC balance control for CH1 or Y. When turning VOLTS/DIV (1) adjust this control so the trace does not shift vertically.

(32) DC BALANCE
Vertical DC balance control for CH1 or Y. When the GAIN (51) control of the vertical amplifier is being turned, DC balance should also be adjusted to fix the trace position. This adjustment should be carried out after having set ATTENUATOR BALANCE (31) correctly.

(33) GAIN PRESET
Fine adjustment control for preset of CH2 vertical attenuation. Four preset gains can be set and selected by GAIN PRESET (6).

(34) ATTENUATOR BALANCE
Vertical DC balance control for CH2 or X. When being turned the VOLTS/DIV (5), adjust so the trace does not shift vertically.

(35) DC BALANCE
Vertical DC balance control for CH2 or X. When the GAIN (54) control of the vertical amplifier is being turned, DC balance should be adjusted to fix the trace position. This adjustment should be carried out after having set ATTENUATOR BALANCE (34) correctly.

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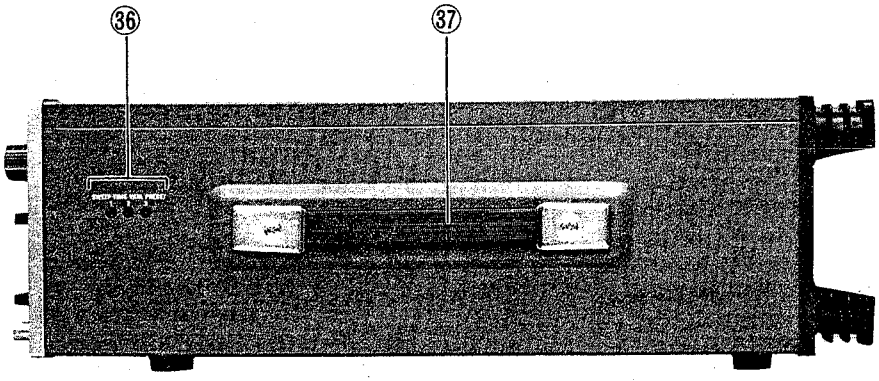
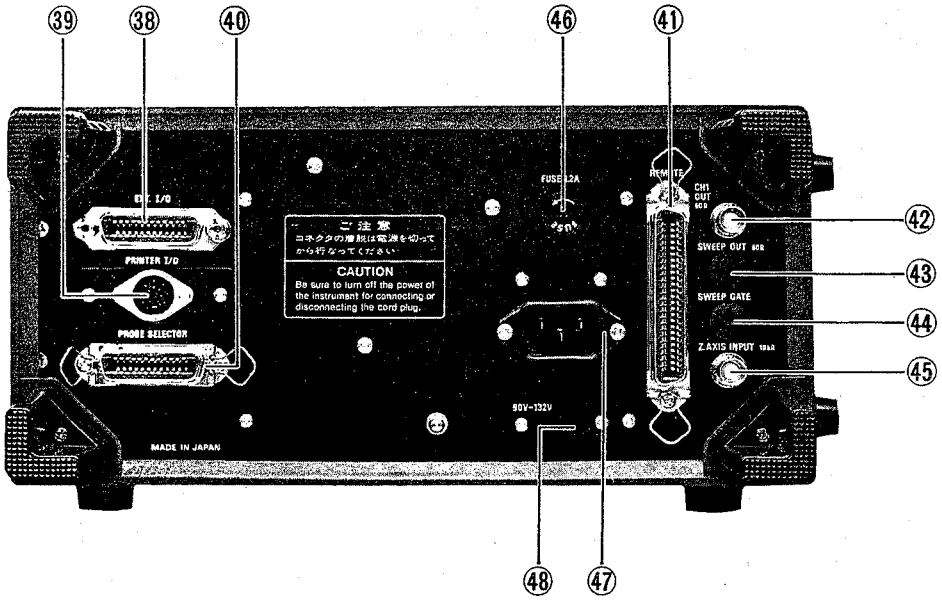


(36) SWEEP TIME VARI PRESET
Control for fine adjustment of preset time base. Changes between ranges of SWEEP TIME/DIV continuously. Ranges can be set and selected by SWEEP TIME VARI PRESET (18).

(37) CARRYING HANDLE
The oscilloscope should be carried using this handle.

<REAR PANEL>



(38) EXT I/O
Connecting socket for optional memory pack (MT-1725) and the other external unit.

(39) PRINTER I/O
Connecting socket for optional printer (TP-1724).

(40) PROBE SELECTOR
Connector for optional probe selector (RU-1722, RU-1723).

(41) REMOTE
Connector for optional remote controller (RT-1721).

NOTE
When connecting or disconnecting any of the above accessories (38), (39), (40), (41), ensure the power switch is in the OFF position.

(42) CH1 OUT
Vertical signal output terminal of CH1.

(43) SWEEP OUT (OPTIONAL)
Mounting point for output terminal of sweep signal.

(44) SWEEP GATE (OPTIONAL)
Mounting point for output terminal of sweep gate signal.

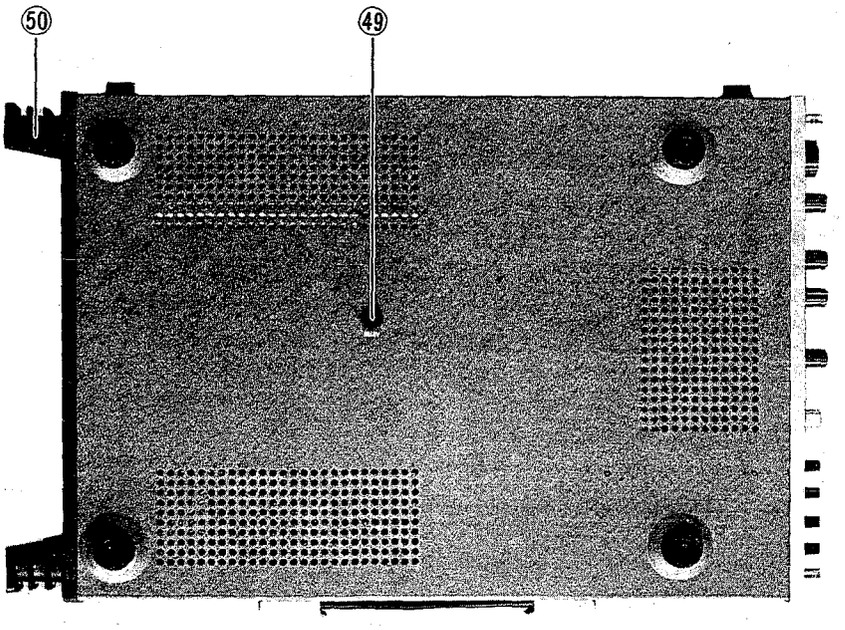
(45) Z-AXIS INPUT
Intensity modulation terminal. Intensity is modulated at TTL level.

(46) FUSE HOLDER
Carries 1.2 A fuse.

(47) POWER SOURCE CONNECTOR
Connector for AC power input cable. Center pin of three-wire cord is ground terminal.

(48) POWER SUPPLY SELECTOR SWITCH
This switch must be adjusted according to the available AC power.
LOW: 90 V — 132 V; **HIGH:** 180 V — 264 V.

<BOTTOM>

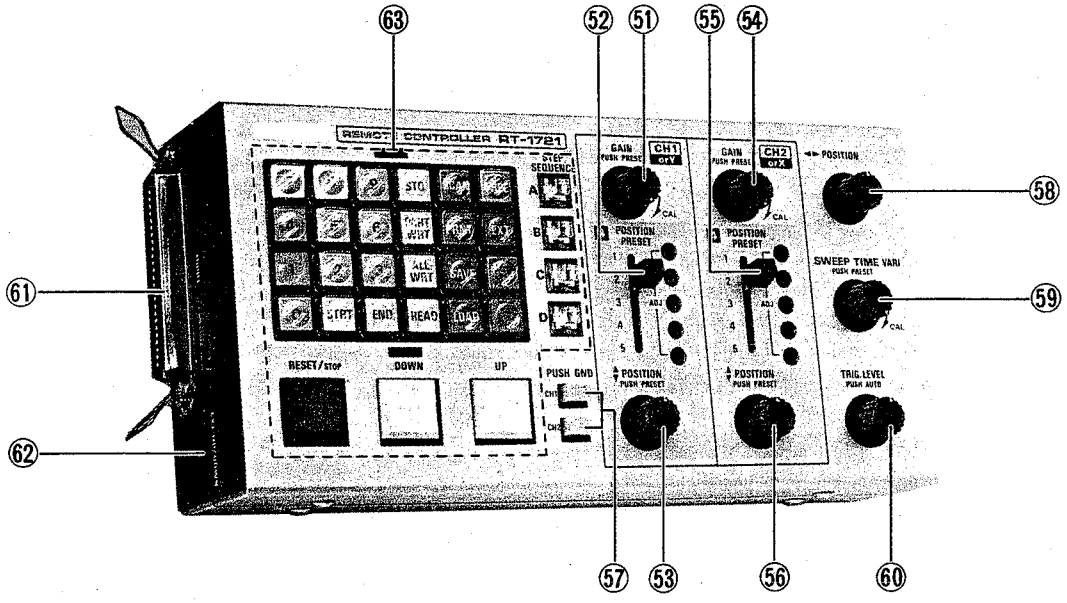


(49) ASTIG
Trace or spot astigmatism compensation control. Once adjusted, this control does not need frequent readjustment.

(50) FEET/CABLE WRAP
When the CS-1720 is used upright (vertically), these mouldings act as feet. The AC power cable can also be wrapped around them when the CS-1720 is not in use.

REMOTE CONTROLLER: RT-1721 (OPTION)

<REMOTE OPERATION SECTION>



(51) GAIN PUSH PRESET

CH1 vertical attenuation fine adjustment control. Continuously variable between the ranges of VOLTS/DIV (1). At CAL position, (fully clockwise), vertical attenuator can be calibrated. For X-Y operation, it becomes the Y-axis attenuation fine adjustment control. When this control is pushed in (PUSH PRESET), the former function is cancelled, and the gain can be set by GAIN PRESET (2) or (29), and the gain is that value which is programmed or selected.

(52) POSITION PRESET

CH1 vertical position, preset and preset change-over control. Continuously variable within ±4 div on the screen. 5 point presets are set and selected.

(53) POSITION PUSH PRESET

CH1 vertical position control. POSITION PRESET (52) can be adjusted approximately of ±2 div. In X-Y operation, Y-axis position control, in addition to POSITION PRESET (52). When this control is pushed in (PUSH PRESET) the former function is cancelled, and the position can be set by POSITION PRESET (52) and the trace is positioned at the programmed or selected position.

(54) GAIN PUSH PRESET

CH2 vertical attenuation fine adjustment control. Continuously variable between the range of VOLTS/DIV (5). At CAL position (fully clockwise), vertical attenuation can be calibrated. In X-Y operation it becomes the X-axis attenuation fine adjustment control. When the control is pushed in (PUSH PRESET), the former function is cancelled, and the GAIN PRESET (6) and (33) sets or selects the gain. The gain is then that value selected or programmed.

(55) POSITION PRESET

CH2 vertical position preset and preset change-over control. Continuously variable within ±4 div on the screen. 5 point presets are programmed and selected.

(56) POSITION PUSH PRESET

CH2 vertical position control. POSITION PRESET (55) can be adjusted approx ±2 div. During X-Y operation it serves the dual function of X-axis position control as well as POSITION PRESET (55). When this control is pushed in (PUSH PRESET), the former function is cancelled, and the position can be preset by POSITION PRESET (55), and the trace is positioned at where it was selected or programmed.

(57) PUSH GND

CH1: When the knob is depressed, input of the vertical amplifier is disconnected from the CH1 input and connected to ground. Therefore the reference level can be easily ascertained.

CH2: When the knob is depressed, input of the vertical amplifier is disconnected from the CH2 input and connected to ground. Therefore the reference level can be easily ascertained.

(58) ◄► POSITION

Horizontal position control. Cannot be used during X-Y operation.

(59) SWEEP TIME VARI PUSH PRESET

Sweep time fine adjustment control. Continuously variable between SWEEP TIME/DIV ranges. At fully clockwise CAL setting, sweep time is calibrated. When this control is pushed in (PUSH PRESET) the former function is cancelled, and the sweep rate can be set by SWEEP TIME VARI PRESET (18) and (36) and the sweep rate is that value set or programmed.

(60) TRIG LEVEL PUSH AUTO

Adjust starting point for displayed waveform.

PUSH AUTO: Sweep will be initiated by trigger signal. Even when there is no trigger signal, free run sweep is possible, and the trace will appear.

PULL NORM: Sweep is initiated with trigger signal. Where there is no trigger signal, the sweep will not appear.

NOTE

When this control is pulled out (PULL NORM) FIX operation is cancelled, and manual operation is selected.

(61) INPUT

Connector for oscilloscope CS-1720 and remote controller. Connecting cable provided must be used.

(62) EXT UP/DOWN (OPTIONAL)

Mounting point for external UP/DOWN control signal connector.

<PROGRAMME OPERATION SECTION>

(63) PROGRAMME CONSOLE KEYS

0 — 9: Number key. Step numbers and/or block numbers can be set up directly.

STO: The memory key. The programme which has been set up can be written into the RAM.

PART WRT: The part writing key. Part writing state is actuated by 0-8 block units. READ and WRITE LEDs will light up.

ALL WRT: The writing key. All blocks are written into the memory. WRITE LED will light up.

READ: The read out key. Programmed data are read from the memory. The READ LED will light up, and the CS-1720 will operate according to the programme contents.

STRT: Start step setup key. Used for setting up and reading out start step numbers in STEP SEQUENCE.

END: End step point key. Used for setting up and reading out end steps from STEP SEQUENCE.

SCAN: Automatic step transfer key; It automatically advances the steps one by one with about a one second interval between steps.

PRNT: The printer key. Programme contents are printed out.

SAVE: Key for data transfer to memory pack, transferring contents of internal RAM. RAM contents are not altered in any way.

LOAD: Data transfer key from memory pack to RAM. Contents of memory pack remain unaltered.

NOTE

When memory pack is not connected, in order to protect the data, LOAD does not operate.

FREE: Programmed function removal key; all programmed function is cancelled, and ordinary oscilloscope operation is resumed with manual operation. All LEDs will be out except POWER warning lamp. The console keys cannot be operated except RESET/STOP (cancelling key).

EXT: External signal control key. Step control of signal read out unit can be carried out with external signal. At this time, only STEP will be indicated, and only RESET/STOP key on the console can be operated.

STEP SEQUENCE: Programme step (start step to end step) selection key; in steps 00 — 61,4 cases where start or end step has been set can be selected at random.

RESET/STOP: Key for resetting and temporary stopping operation;

a) It can be used to read out the preset start step number.

b) When SCAN and PRNT are selected, it becomes a temporary stopping and resetting key.

c) It can cancel FREE and EXT keys.

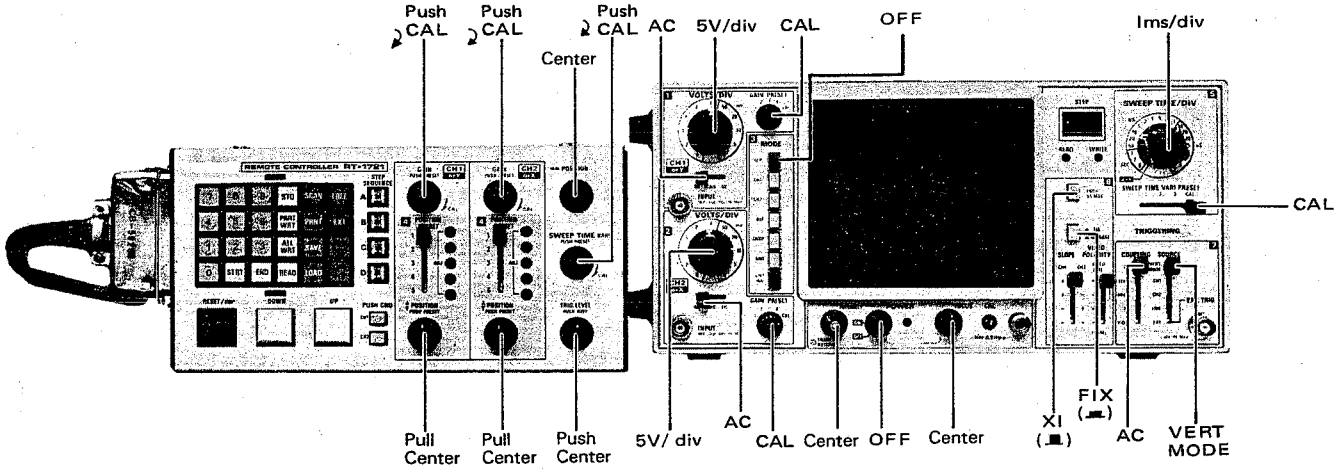
DOWN: Step down key. Brings steps down one by one, stopping at the preset start step, or after reading 00 step.

UP: Step up key; goes up through the steps one by one. It returns to the start step after reaching the preset end step, or after reading 61 step.

OPERATIONS

INITIAL STARTING PROCEDURE

This procedure is used to standardise the initial setting of controls as a reference point and to obtain a trace on the CRT in preparation for waveform observation. Set the controls as in the diagramme, referring to the section on panel controls and indicators for necessary explanations.



ORDINARY OSCILLOSCOPE MANUAL OPERATION

1) Turn the POWER switch (12) clockwise, and the power will come on, indicated by the power pilot light. Check if any of the following LED indicators light up: STEP (26), READ (27) and STEP SEQUENCE (63). If all of them are lit, push console key FREE (63) and the LEDs will go out, indicating that the oscilloscope is now ready for ordinary manual operation.
   Set up each mode as follows:
   MODE (9): CH1
   SOURCE (20): VERT MODE
   TRIG LEVEL (60): AUTO
2) After a short time the CRT will warm up, and the trace will appear. Position the trace in the center of the screen using POSITION PRESET (52), ▲▼ POSITION (53) (pulled out), and ◄► POSITION (58). Next adjust the INTENSITY (10) and FOCUS (14) controls as necessary to obtain a clear, sharp trace.
3) Set the vertical axis MODE (9) to CH1, and apply a signal to CH1 INPUT (4) in order for the waveform to reach normal operational size by rotating VOLTS/DIV (1). Vertical attenuation fine adjustment can be carried out with GAIN (51) switch, pulled into PULL position. By setting vertical MODE to CH2, and applying a signal to CH2 INPUT (8), by following the same procedures as above, CH2 waveform can be observed. By setting vertical mode to ALT, the input signal waveforms of both CH1 and CH2 will be displayed alternately every other sweep, the trigger signal also alternating between CH1 and CH2. Therefore, there will be a momentary pause between the two waveforms.
   When CHOP is selected on vertical MODE, CH1 and CH2 will be indicated by chopping, each sweep. As the trigger signal becomes the CHOP change-over signal in this mode, select an appropriate setting for SOURCE (20), except VERT MODE. These two waveforms have the same time base. When ADD is selected on the vertical MODE, the waveform on the screen becomes a composite algebraic sum of CH1 and CH2 in single trace. If CH2 INV is then selected in this condition, the waveform is the algebraic difference between CH1 and CH2 (CH1 − CH2). When VOLTS/DIV is set the same for both channels, the sensitivity has that value.

<SEP OPERATION>

Select SEP of the vertical MODE, and set CH1 or CH2. In this setting, the input signals will be indicated by alternate sweeping in main and sub mode with dual trace function. In the case of CH1 being selected, the CH1 signal is the main sweep, the position being adjusted with CH1 ▲▼ POSITION. The sub trace can be adjusted to within ±4 div of the CH1 trace by means of SEPARATE PRESET (30) on the left hand side of the CS-1720. It is then controlled by CH1 ▲▼ POSITION. The sync polarity of both main and sub traces correspond to CH1 +/− and CH2 +/− of SLOPE (23). (Refer to table 3.) If CH2 is selected, then CH2 becomes the main trace, and CH1 the sub. The same operating instructions apply as for CH1 operation.

NOTE

Do not set the sub trace exceed the ±4 div setting, distortion may appear on the waveform.

<TRIGGERING OPERATION>

In order to observe the input signal waveform, a correct trigger signal is necessary. There are two possible types of trigger; one is the internal trigger, where the signal is internal, and the other is an external trigger, where the trigger signal is applied to the external trigger input terminal; This signal must have a time or frequency relationship to the signal being observed to synchronize the display.

1) A combination of SOURCE and vertical MODE settings decides which signal is the trigger signal, as shown in Table 1.

SOURCE / VERT. MODE	VERT MODE: EXCLUDING VERT MODE	VERT MODE: VIDEO	CH1	CH2	LINE	EXT
CH1	CH1	CH1	CH1	CH2	LINE	EXT
CH2	CH2	CH2				
ALT	CH1: CH1 CH2: CH2	CH1 see note (1)				
CHOP	see note (2)					
ADD	(CH1 + CH2)	(CH1 + CH2)				

Table 1 Relation between Vertical MODE and SOURCE

Note 1) In the case of VIDEO FRAME, the alternate traces of CH1 and CH2 appear on the screen, but both CH1 and CH2 displays are triggered with CH1 signal only.

Note 2) As the CHOP change-over signal becomes the trigger signal, triggering is not properly carried out. In this case, set SOURCE excluding VERT MODE.

2) After setting SOURCE, select MANUAL (■) of FIX/MANUAL (24) and turn TRIG LEVEL (60) to selecte the trigger point. Alternately, by selecting FIX (▬), triggering is automatically fixed in the center of the waveform.

3) By pulling the TRIG LEVEL control to outward, NORMAL operation is selected, under which triggering is not automatic, so that in the case of no trigger signal or the trigger level is too low, no trace will appear. Table 2 shows the relation between FIX/MANUAL and AUTO/NORMAL.

TRIG LEVEL / FIX/MANUAL	AUTO (PUSH)	NORMAL (PULL)
FIX	Auto sweep Level fix	Triggered sweep Level adjustable
MANUAL	Auto sweep Level adjustable	Triggered sweep Level adjustable

Table 2 The Relation between FIX/MANUAL and AUTO/NORMAL

<SYNC POLARITY>

SLOPE (23) sets the sync polarity of CH1 +/−, CH2 +/−. In the case of VIDEO FRAME, odd and even fields can be selected.

SEPARATE	SOURCE / VERTICAL MODE	VERT MODE	CH1	CH2	LINE, EXT
ON	CH1	Main: CH1 +/− Sub: CH2 +/−	CH1 +/−	CH2 +/−	Main: CH1 +/− Sub: CH2 +/−
	CH2	Main: CH2 +/− Sub: CH1 +/−			Main: CH2 +/− Sub: CH1 +/−
OFF	CH1	CH1 +/−	CH1 +/−	CH2 +/−	CH1 +/−
	CH2	CH2 +/−			CH2 +/−
	ALT	CH1: CH1 +/− CH2: CH2 +/−			CH1: CH1 +/− CH2: CH2 +/−
	CHOP				CH1 +/−
	ADD	CH1 +/−			

Table 3 Sync Polarity

<VIDEO SYNC>

When COUPLING (21) switch is in the VIDEO, the sync is on the VIDEO signal.

1) When VIDEO POLARITY (22) switch is in the VIDEO LINE, the trigger signal is the horizontal sync signal (TV. H) on the VIDEO signal.
When VIDEO POLARITY switch is in the FRAME, triggering is carried out by vertical sync signal (TV. V) on the VIDEO signal.

2) According to the waveform of the VIDEO input signal select VIDEO POLARITY LINE (+/−) or FRAME (+/−) depending on the polarity of the sync signal. When VIDEO FRAME is selected, odd and even fields can be set by SLOPE (23) CH1 +/− or CH2 +/−. The polarity of the observed waveform may be reversed when moving from one monitoring point to another; Therefore, it may be necessary to switch from VIDEO POLARITY + to − (or − to +) or vice versa.

3) Field selection in single trace observation.
Set SOURCE in CH1 or VERT MODE, and synchronize the input VIDEO signal for CH1. Now odd and even fields can be selected using SLOPE CH1 +/−. For CH2, SLOPE CH2 +/− changes the field.

4) Field selection in dual trace operation.

- When SOURCE is set to VERT MODE, vertical MODE to ALT, and the same signal is applied to CH1 and CH2, the input signal of CH1 will be the trigger signal. Now odd or even field can be selected using SLOPE CH1 +/− or CH2 +/− respectively. When CH1 +/CH2 − or CH1 −/CH2 + is set, it is possible to view odd and even fields simultaneously.
- When SOURCE is set to VERT MODE and CH1 SEP mode is selected, SLOPE is CH1 +/− on the main and CH2 +/− on sub. Odd or even field can be selected respectivily. In the case of CH2 SEP mode, SLOPE is CH2 +/− on main and CH1 +/− on sub. When CH1 +/CH2 − or CH1 −/CH2 + is set, it is possible to view odd and even fields simultaneously.

<SWEEP MAGNIFICATION>

If a part of the trace were enlarged on the screen, that part which is selected for close observation might be off the screen, when the sweep rate is shorted. In such a case, the following procedure should be carried out. First, using the ◄► POSITION adjust the desired portion of waveform to center of the CRT. Secondly, depress X5 MAG (19) knob (▬) and the trace will be enlarged five times. The sweep rate in this case becomes one-fifth of the set value of SWEEP TIME/DIV.

<X-Y OPERATION>

By using the oscilloscope CS-1720 for X-Y operation, frequency response, frequency measurements, phase shift measurement and other similar measuring functions can be carried out. Turn the SWEEP TIME/DIV control fully counterclockwise to the X-Y position. The CH1 (or Y) signal indicates the vertical axis Y, and the CH2 (or X) signal indicates the horizontal axis X. Adjustment of the X-Y position is carried out using CH1 ▲▼ POSITION for the Y-axis and the CH2 ▲▼ POSITION for the X-axis. The sensitivity of both X and Y components during X-Y operation is controlled by VOLTS/DIV, VARIABLE in CH1 and CH2 respectively.

PROGRAMMING

Programming for the CS-1720 oscilloscope is carried out completely by console key operation. The keys are classified under three types according to the function.

1) Number keys

0 – 9

2) One-key operation

RESET, UP, DOWN, SCAN, PRNT, FREE,
EXT, SAVE, LOAD, A, B, C, D:

3) Multi-key operation

ALL WRT, PART WRT, STO, READ, STRT, END.
The operating contents of these keys will be changed at any time by pre-keying or further keying.

1. EXPLANATION OF CONSOLE FUNCTIONS

1) 0 – 9

These keys set up the step numbers and/or the block number for part writing. The keyed step number will be indicated on the seven-segment STEP LEDs. Two numbers will be indicated for steps 00 – 61, but only one figure will be indicated for block numbers 1 – 8.

2) RESET/STOP

Basically this key returns the programme to the START STEP of the sequence regardless of the set condition. The CS-1720 will then remain in the READ condition. In the case of SCAN or PRINT operation, this key serves as a pause or reset key. If the key is pressed once, in SCAN or PRINT operation, the CS-1720 will pause in the middle of the operation. If the SCAN or PRNT key is then pressed, operation will resume. If the RESET key is pressed twice in succession, the programme will return to the START position, PRINT or SCAN will stop, and the CS-1720 will remain in a READ condition.

3) UP

This control advances the step numbers one by one from the STEP number indicated. When END STEP is reached, it returns to START STEP of the step sequence. If no END STEP is set, or if the UP key is pushed beyond the END STEP key setting, steps will proceed to the last step 61, and will then return to the START STEP of the step sequence, and stop.

4) DOWN

Reduces STEP numbers one by one from indicated STEP number until START STEP of step sequence is reached, and it will stop. If there is no set START STEP, or if the DOWN key is pressed before the START STEP setting it will return to step 00, and then go on to the START STEP, and stop.

5) STEP SEQUENCE (A, B, C, D)

The combination between programme start and step can be set in up to 4 settings (A, B, C, D). Following the programmed STEP number, steps can then be set up at random continuously between 00 – 61. This combination is set from the A to D keys, and once selected, the oscilloscope will be in the READ condition at the start step. The A, B, C, D programme is preset, and remains set when the power is OFF, being indicated by the appropriate LEDs when power is once again switched on.

6) SCAN

In READ condition, SCAN operation advances the steps one by one with a one-second interval between steps until the END STEP is reached, when it will return to the START STEP and stop in READ. However if no END STEP is set or if the SCAN key is pushed beyond the END STEP setting, the steps will be advanced until 61, after which it will return to the START STEP and stop.

Pause action: Pause in SCAN action is achieved by pressing the RESET key. If the SCAN key is again pressed, scanning will resume.

Cancellation: If the RESET key is pressed twice in succession, the SCAN action will be cancelled, and the CS-1720 will return to the START STEP, in read condition.

7) PRNT

Operates the printer, TP-1724, and the programme data are printed out. Printing is done from the step indicated and continues until step 61, when printing will stop and the CS-1720 will return to the START STEP in the step sequence.

Pause action: Pause of printing action is achieved by pressing the RESET key once. The printer will print up to the 8 block of that step, and stop. Pressing again the PRNT key will resume printing from the following step.

Cancellation: Cancelling printing is done by pressing RESET key twice in succession, when the CS-1720 will return to the START STEP of the step sequence, and printing will stop.

8) FREE

All programmed functions are cancelled, and the CS-1720 becomes a normal oscilloscope with manual control. At this time, FREE can be cancelled by pressing RESET.

9) EXT

The STEP number can be controlled by the external BCD signal, connected to EXT I/O. EXT action is only possible under READ condition, when the STEP SEQUENCE LED is off. When the external signal is disconnected, step sequence 00 is indicated. To cancel EXT action press RESET.

NOTE

During SCAN, PRNT, FREE, and EXT action, all keys except RESET are cancelled and inoperable.

10) SAVE

Transfers the RAM programme data in the memory of the CS-1720 to the memory pack MT-1725. This transfer is effected without changing the RAM contents of the CS-1720 internal memory. When data transfer is finished, a buzzer will sound and the READ or WRITE LED will flash once.

11) LOAD

Transfers the contents of the memory pack MT-1725 to the internal RAM of the CS-1720, without altering the memory pack contents. When the transfer is finished, the buzzer sounds and the READ or WRITE LED will flash as in SAVE above.

When the memory pack is not connected, LOAD will not operate to protect the data in the memory.

NOTE

If SAVE is pushed by mistake instead of LOAD, or vice versa, all important data will be changed. Accordingly be sure to press the correct key.

12) STRT

Start step sequence key. Used for setting up START STEP numbers and/or read out the start step number of the sequence.

13) END

End step sequence key. Used for setting up END STEP numbers and/or read out the end step number of the sequence.

14) READ

The read out key. When pressed, the green READ LED will light and programme will be read out at the indicated step. It operates according to the programme contents.

15) ALL WRT

All blocks are set in WRITE state completely and total panel control operation is possible; and red WRITE LED will light. All panel controls can be set up for programming.

NOTE

The data of the panel set up is stored into RAM only when STO key is pressed.

16) PART WRT

Selects part writing function both READ and WRITE LEDs light up and STEP LED is off.

Set up one of the block number keys from 1 to 8, which necessary to change the mode. In this case, only block number which has been set in PART WRITE state, is indicated in one figure. Panel control operation is possible in the only block which has been set up and can be set up for programming. All other blocks are set in READ state, therefore panel control operation is impossible.

NOTE

When STO key is pressed, part writing of only the block preset will be done, without altering the rest of the blocks.

If it is necessary to change the block number to be part written, press the desired key before pressing the STO key. After part writing is completed, the step number is advanced by one, and is so indicated. The oscilloscope will be in ALL WRT state.

17) STO

The memory activation key. It is used for all writing actions, ALL WRT, PART WRT, START STEP, END STEP.

ALL WRT: The programme setting of each panel switch in all blocks is stored as data, advancing the step number by one.

PART-WRT: Each panel switch programme setting in designated block only, is stored as data, advancing step number by one.

STRT/END: Sets up start steps and end steps of the programme and writes them.

2. PROGRAMME OPERATION

Referring to the section on manual oscilloscope operation, switch on the power switch. Check if any of the STEP (26), READ (27) LEDs and one of the STEP SEQUENCE LEDs are lit or not. With the green READ LED lit, the oscilloscope is ready for operation.

NOTE

If at the beginning of operation the first stage programme setting has not been done, all A, B, C, D LEDs may be lit and the buzzer may be sounding. In this case, reset A, B, C, D or push the RESET key. If the buzzer continues to sound, turn power OFF and check each external cable connection before switching on again.

When the oscilloscope is ready for operation, press the RESET key.

I) UP/DOWN Operation for STEP

Continuous STEP UP

With each operation of the UP key, STEP is advanced one by one. When END STEP is reached, it returns to the START STEP. If the UP key is pushed after the END STEP setting, the steps will be advanced until step 61, after which it will return to START STEP. If the UP key is pressed from a number below START STEP, the steps will be advanced till END STEP, and will then return to START STEP.

Continuous STEP DOWN

Each operation of the DOWN key will reverse the step numbers indicated by one, until the START STEP is reached, and operation will stop. If the DOWN key is pressed at a number below the preset START STEP, the steps will go down to 00, then to START STEP and operation will stop. If DOWN is keyed beyond END STEP preset number, normal decrease of steps occurs till START STEP, then operation will stop.

II) START STEP, END STEP Setting

a) STEP SEQUENCE setting

Select one of the keys from A to D and push. The corresponding LED will light up.

b) START STEP setting

Using the number keys, indicate in the window the number of the required step. Push START and STO key in that order, then the START STEP is set up.

c) END STEP setting

Using the number keys, indicate in the window the required number. Push END and STO keys in that order, and the END STEP is set up. Now the programme extent has been set up and recorded in the memory. Using the same procedure as above, three other sequence can be set up.

III) START — END STEP Reading out

a) STEP SEQUENCE selection

From A to D keys select the key to be read, and push it. At this time the START STEP number is indicated in the STEP (26) window, and the oscilloscope will be in the READ state.

b) START STEP, END STEP reading

By pushing START and READ keys in that order, start step reading is possible; similarly, if END and READ keys are pushed in that order, end step reading can be carried out.

IV) PROGRAMME Writing Operation

(1) ALL WRITE

a) STEP Number setting

Set up STEP number for STEP (26) using number keys or UP/DOWN key.

b) ALL WRITE setting

When ALL-WRT key is pushed, the green READ LED will go out, and the red WRITE LED will light. In this setting, panel operation of the oscilloscope is possible.

c) Writing in

By pushing STO key, the setting of every control is stored into the memory. The STEP number is advanced by one to the next step, and the oscilloscope is still in the WRITE condition.

d) Continuous writing in

Under setting (c) above, if each switch is set up and the STO key operated in that order, the programme can be continuously written in.

(2) PART WRITING in

a) STEP number setting

Set up as for ALL WRT above.

b) PART WRITING in setting

By pushing PART WRT key, the STEP LED (26) will go out, and the green and red LEDs of READ and WRITE will light up; the oscilloscope is now in PART WRT condition. Set up the desired block number from 1 to 8, using the number keys. The number will be indicated in the STEP window of the front panel. Panel operation is only possible for the preset block, and the setting for each control will be written in. All other blocks are in READ condition, and panel operation with them is not possible.

c) Writing in

By pushing STO key only the memory of the contents of the set up block can be changed. The STEP number is advanced by one to the next step, and the CS-1720 is in ALL WRITE condition.

V) Programme Reading Operation

(1) Setting up for READ condition

a) Reading of START STEP

By keying RESET or STEP SEQUENCE, START STEP reading condition is achieved. In this case reading from programme in the STEP SEQUENCE can be continuously carried out, using the UP key.

b) Reading of direct STEP

Set up the desired step numbers using the numbers key or UP/DOWN key. The numbers will be indicated in the STEP window (26) on the CS-1720 front panel. By pressing READ key any step can then be directly read.

VI) Manual Operation of CS-1720 Oscilloscope

When FREE key is pressed, all programmed functions are cancelled and manual operation of the CS-1720 is possible as for any normal oscilloscope. The LEDs for STEP, READ, WRITE, and STEP SEQUENCE are all off. All keys except RESET cannot be used. By pushing the RESET key, FREE action is cancelled.

VII) Automatic Step Transfer Operation

In READ condition, pushing the SCAN key automatically advances the STEP setting from the indicated step through to the end, with a period of about one second between steps. When the end step is reached, the CS-1720 automatically returns to the START STEP and stops.

During SCAN operation, all keys except RESET are inoperable.

Pause action: During SCAN operation, pushing the RESET key will temporarily stop the action. To continue, press the RESET key once again.

Cancellation: The SCAN operation can be stopped if the RESET key is pressed twice in succession. In such a case, the CS-1720 will return to the START STEP and stops.

OPERATION OF OPTION

I) Probe Selector Control and Operating Instructions

The Probe Selector (RU-1722, RU-1723) control can be used in combination with CH1 input, CH2 input, and EXT input of the CS-1720. Also, manual operation of the oscilloscope with the probe selector is possible after pushing FREE key. In Programmed action, the selector becomes the programme section for one part of blocks 7 and 8.

a) Connections with RU-1722

In combination with RU-1722, inputs can be selected as follows:

CH1; 5 inputs
CH2; 5 inputs
EXT; 3 inputs

b) Connections with RU-1723

The following inputs can be selected in combination;

CH1; 10 inputs
CH2; 10 inputs
EXT; 3 inputs

NOTE

(1) The probe selector (RU-1722, RU-1723) power is interconnected with the CS-1720 oscilloscope. For detailed connection and operation instructions, refer to the probe selector instruction manual.
(2) When connecting and disconnecting the probe selectors, make sure power switch of the CS-1720 is in the OFF position.
(3) Use CH1 and CH2 input coupling of oscilloscope in the AC position.

II) Operation of The Printer

Connect the Thermal printer TP-1724 to the PRINTER I/O connector on the rear panel of the CS-1720, referring to the printer TP-1724 instruction manual for detailed instructions. Pressing PRNT key activates the printer, and a hard copy of the programme data is printed out, from the step indicated at the time of pressing the PRNT key to step 61, whereafter it will return to START STEP and stop. During printing, the step number indicated on the CS-1720 STEP window will not alter, and all keys except RESET are inoperable.

Pause action: During PRINT action, press RESET key. Print-out will continue till the end of that step, and stop. When PRNT key is pushed again, print-out will continue from the next step.

Cancellation: Print operation can be fully stopped if the RESET key is pressed twice in succession. Print-out will stop, and the CS-1720 will return to START STEP.

NOTE

If PRNT key is pressed when the printer is not or improperly corrected, a warning buzzer will sound. The buzzer can be cancelled by pressing RESET key.

III) Programme Transfer

By connecting Memory Pack MT-1725 to the EXT I/O connector on the rear panel of the CS-1720, data of internal RAM can be transferred in or out.

a) From CS-1720 to Memory Pack MT-1725

By operating SAVE key, programme data contents of the RAM are transferred to the Memory Pack MT-1725.

b) From Memory Pack MT-1720 to CS-1720

By pressing LOAD key, contents of memory pack will be transferred to CS-1720 internal RAM.

In both transfer modes, the programme contents of the transferring unit remain unaltered. When transfer is complete, a buzzer will sound, and the READ or WRITE LED will flash once.

NOTE

When the memory pack is not connected, LOAD key is not effect to protect the data. When connecting or disconnecting the memory pack, be sure power is OFF in order to protect the data. In addition, do not subject the equipment to electrical shocks, due to the fact that the body contains the back-up battery for the memory. High temperature and humidity should also be avoided. When the Memory pack back-up battery is low, the STEP LEDs will flash on and off indicating a change of battery is necessary. If a mistake is made, and SAVE is pressed instead of LOAD, or vice versa, the data will be lost, therefore great care should be taken to push the correct button.

VI) Step Control Operation from External BCD Signal

Step numbers can be controlled from an external BCD unit connected to the EXT I/O socket on the rear of the CS-1720 body. EXT operation is only possible in READ operating condition, with STEP SEQUENCE LED off. If no external signal is connected, when this key is pushed, step 00 will be indicated. To cancel EXT operation, push RESET key.

CIRCUIT DESCRIPTION

Refer to block diagramme.

CENTRAL PROCESSING UNIT, I/O CIRCUIT

The CS-1720 oscilloscope programmable section is totally logic controlled. The central processing unit (CPU) generates the logic signal to operate this circuit from the CPU output terminal. Logic signals are received from the CS-1720 main panel controls, the probe selector, the remote controller, and other control sources. These data can be stored in (STO key) or read out (READ key) by keyboard control. The data contained in the memory are guarded (protected) by the backup battery, even when power is disconnected from the CS-1720.

ATTENUATOR UNIT

The input attenuator consists of 1/1, 1/10 and1/100. With series connection, the attenuation ratio becomes 1/1000. Switching relays are employed. The input signal passes through the attenuator and goes to the dual FET and dual transistor circuitry for impedance matching. The gain preset circuit controls the gain of the second vertical amplifier stage.

VERTICAL AMPLIFIER: VERTICAL OUTPUT AMPLIFIER

The signal from the attenuator is fed to the first amplifier stage, the changing gain of this stage is used as the 1 - 2 - 5 step attenuator. The second stage is the VCA employing FET circuitry, with continuously veriable gain. The third stage controls ▲▼ POS, and CH2 side, CH2 INV operation is also controled in this stage. The signals are selected by CH1, CH2, ALT, CHOP and ADD operations according to the vertical mode of the CH1, CH2 selector circuit, and is fed to vertical deflection plates of CRT through the delay line, the trace separation circuit, and the vertical output amplifier. The internal sync signal is provided by the outputs of the third stage amp, and CH1, CH2 selector circuits, amplified by the trigger amplifier, and selected by the trigger source selector switch.

SWEEP UNIT

The external and internal sync signals are selected by the trigger source selector switch, and the selected signal passes through the trigger coupling switch and is amplified by the trigger amp. This signal shaped by the Schmidt circuit becomes clock signal of the sweep gate circuit. When triggered with the VIDEO sync signal, the trigger signal is produced by separating the LINE or FRAME signal from the trigger amplifier output. Sawtooth generator circuit has a regulated current charging circuit which obtains the constant current to capacitor. Sawtooth waveform is amplified in the horizontal output amplifier circuit, and is fed to the horizontal deflection plates in the cathode ray tube (CRT). In X-Y operation, the X-axis signal is selected by the X-Y selector switch, and CH2 vertical amplifier is become horizontal amplifier in this mode.

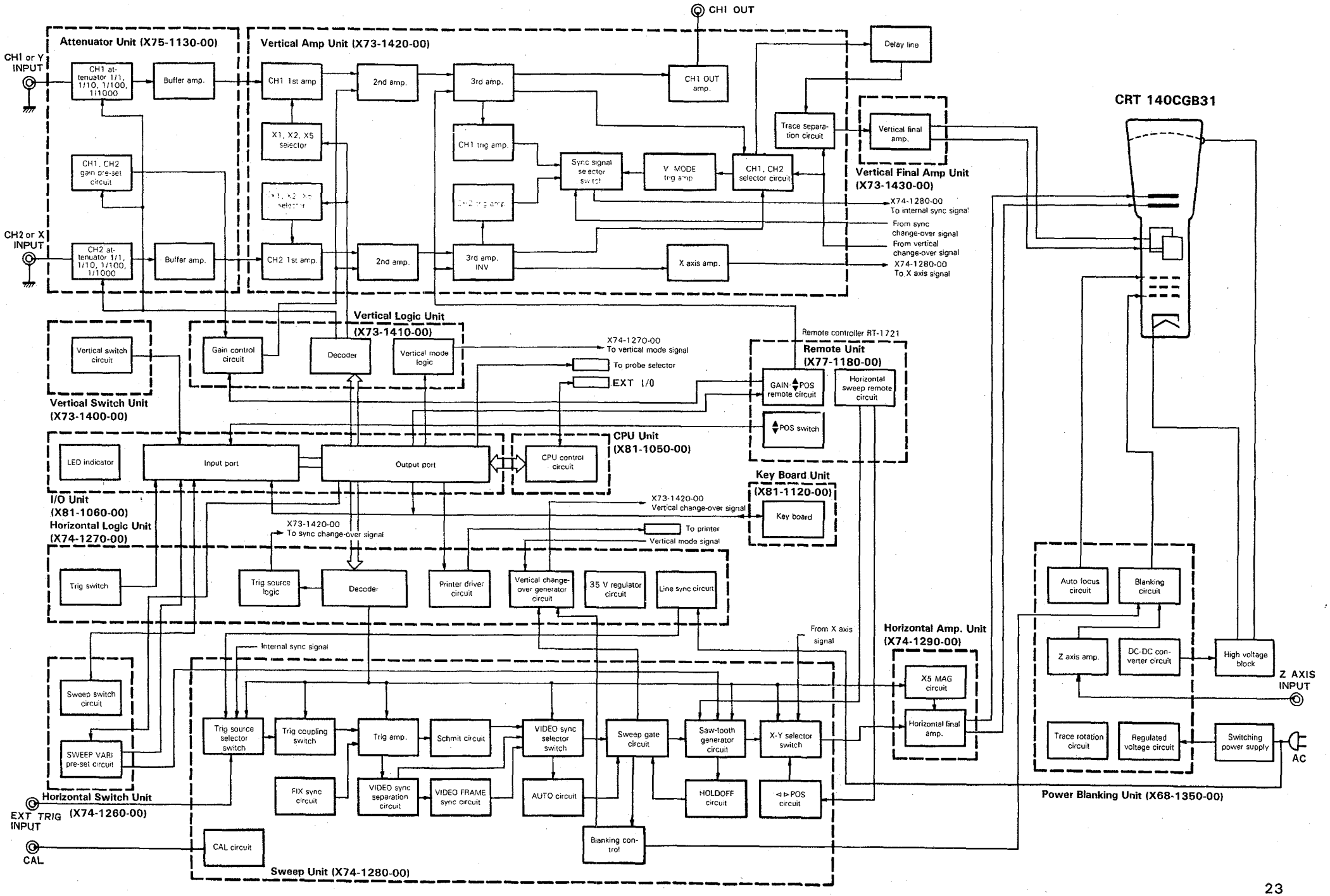
VERTICAL AND HORIZONTAL LOGIC UNITS

The vertical and horizontal logic units relay the logic signals from the CS-1720 control panel, the remote control unit keys, the probe selectors, and other control switches, to the INPUT side of the I/O unit. In addition, the Vertical and Horizontal logic units record suitable operating signals from the OUTPUT terminals. The LINE sync signal is produced from the power line by the line sync circuit which consists of a photocoupler is used to isolate from the power line.

POWER BLANKING CIRCUIT

A voltage regulating circuit ensures constant voltage, power is supplied from the voltage selector unit. A DC-DC convertor produces the CRT acceleration voltage. When the intensity of the trace is adjusted, an autofocus circuit automatically controls the trace focus, thus eliminating readjustment of the FOCUS control frequently.

BLOCK DIAGRAM



MAINTENANCE

REMOVAL OF THE CASE

1. Remove the four phillips screws holding the cable wraps on the rear panel of the CS-1720, using a ⊕ screwdriver. Holding the front panel of the CS-1720, slide the case off backwards.
2. When replacing the unit in its case, slide it horizontally along the locating rails in the case base plate until the front panel is snug against the case.
3. Replace the cable wrap and screws, and tighten securely.

CAUTION

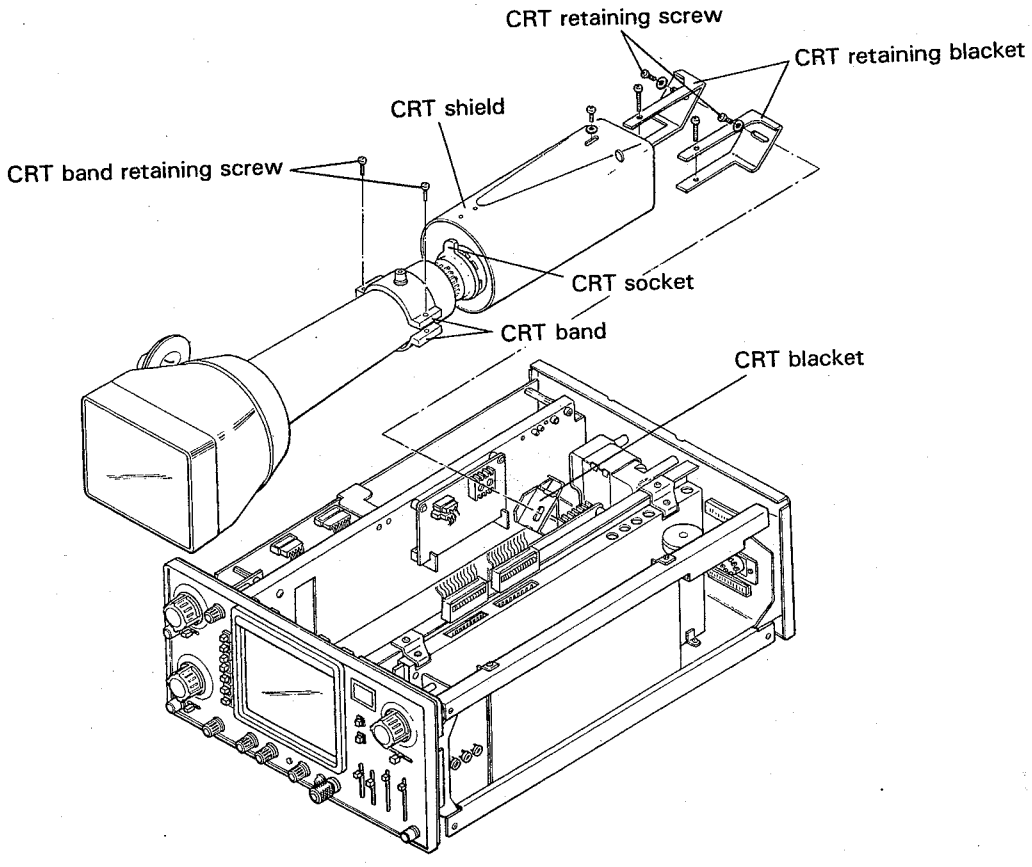
Potentially high voltage (6 kV) is applied to the CRT and anode cap. Before removing the case, ALWAYS switch off the power, and disconnect the power cable from the socket. If power is reconnected after removing the case BE EXTREMELY CAREFUL not to touch them with your hand or screwdriver.

REMOVAL OR REPLACEMENT OF THE CRT

1. When removing the CRT for repair or maintenance, NEVER remove the CRT band. Remove only the mounting screws, and gently slide the CRT backwards, raise the socket up. If the above procedure is followed, removal of the CRT is easily accomplished. Replacement can be done easily.
2. Insert the CRT carefully. After locating the CRT on the retaining rubbers, tighten the CRT retaining screws loosely. Fix the screws of CRT bands so the CRT is in parallel with the frame and then tighten the screws of CRT mounting hardwave.
3. As slots are provided in the CRT bracket, the CRT can be moved right and left, and back and force. As the bracket is inclined by 45°, the CRT can be positione an arbitrary position. To fix the CRT, tighten the CRT taining screws loosely and fix the CRT to be in parallel with the frame. Then, finally, fix the CRT retaining screws tightly.

CAUTION:

A high tension voltage is remained at the anode of the CRT. Before removing the CRT, connect the anode to the ground via a 100 kΩ load for 5 seconds to discharge the voltage.



REPLACEMENT OF SWITCHING POWER SUPPLY

The switching power supply is in a shield case at the lower rear of the CS-1720. To remove the switching power supply, first remove the control and sweep units located on the right, and undo the screws holding the unit to the left/right frame.

REMOVING CONTROL UNIT

First take off the two flat cables on the top of the unit, the three screws and the retaining hex. nut for the seven segment STEP LEDs, thereafter remove the connector on the side of the unit. To replace the control unit, follow the reverse procedure.

NOTE

The control unit has CMOS and RAM backup, therefore be sure to avoid handling it, or any of the connected components, roughly.

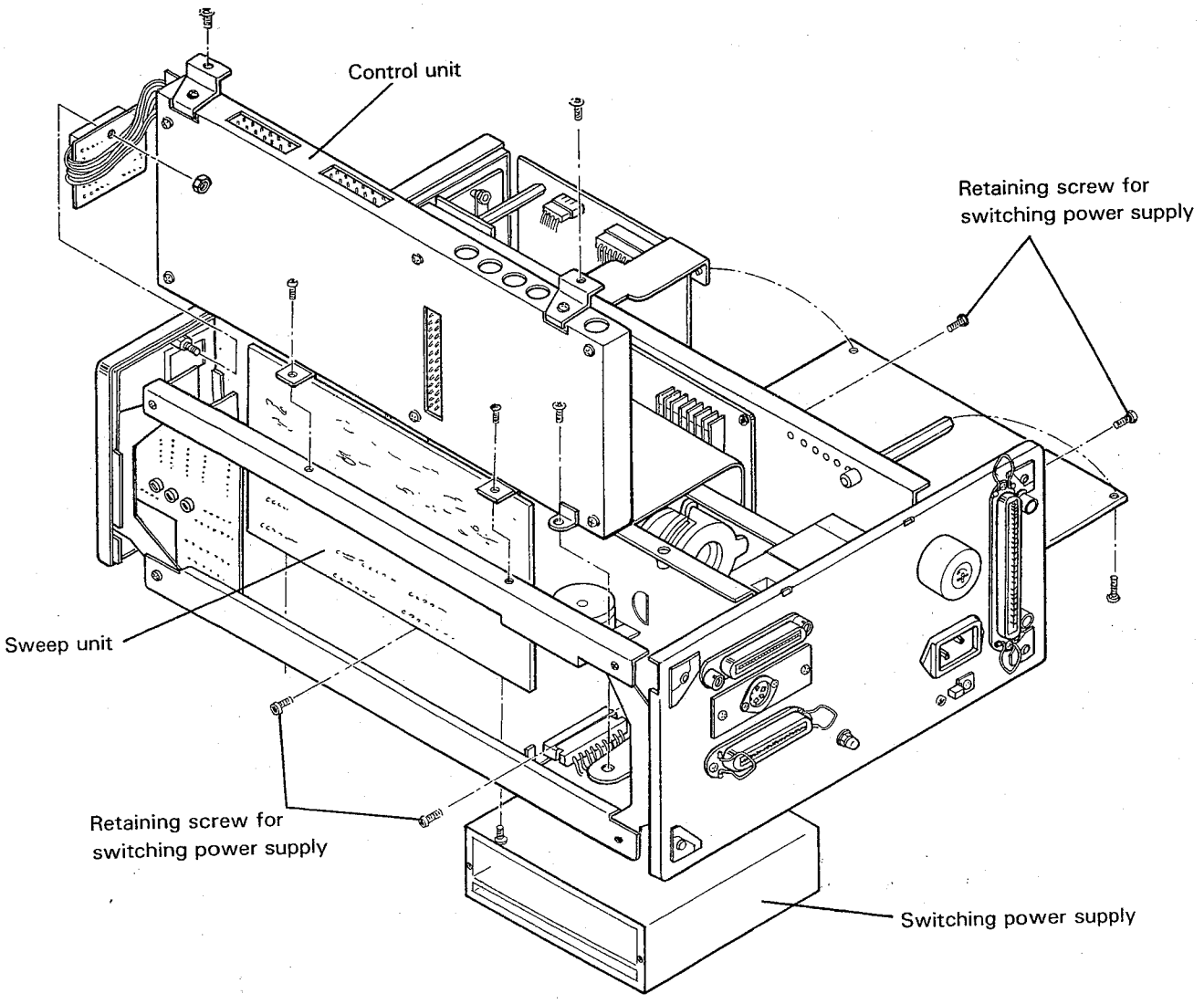
REPLACING THE BATTERY

If the STEP LEDs flash on and off, it is an indication that the memory backup battery is low, and need replacing. In such a case, it must be changed in the control unit as soon as possible.

1. Remove the control unit from the body of the CS-1720 as previously described.
2. Remove the 8 screws on the shield case. The lithium battery is located on the right side of the P.C.B (X81-1050-00). If after checking the battery level it is less than 2 volts, replace with new battery, taking care to observe correct polarity, as shown on the component side of the printed circuit board.

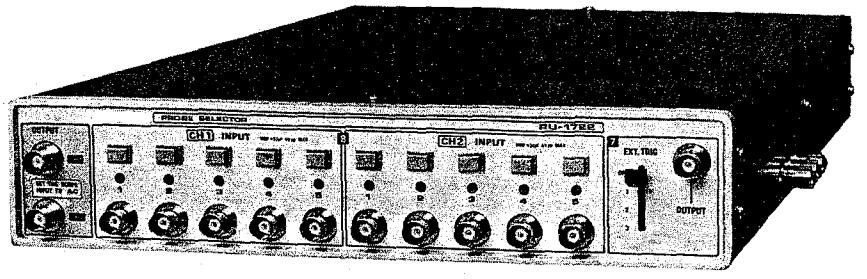
NOTE

Note that if the backup battery of the Memory pack (MT-1725) is low, the STEP LEDs also flash, on and off.

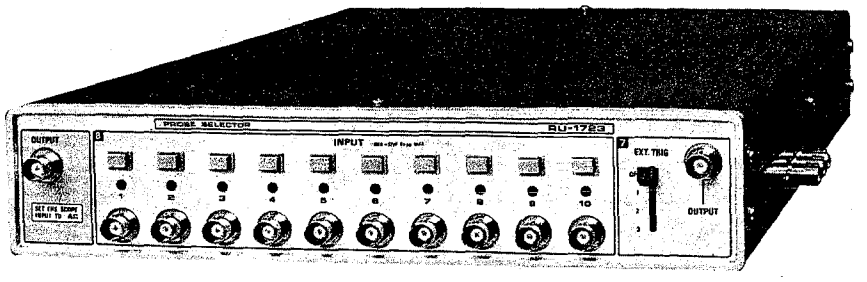


OPTION

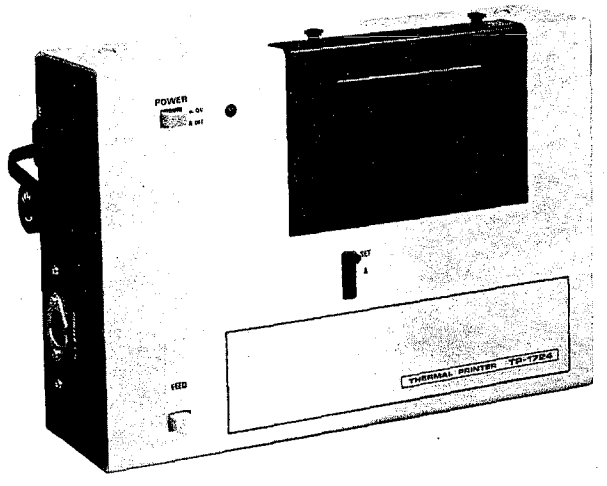
The following accessories are available for more sophisticated operation of the CS-1720.



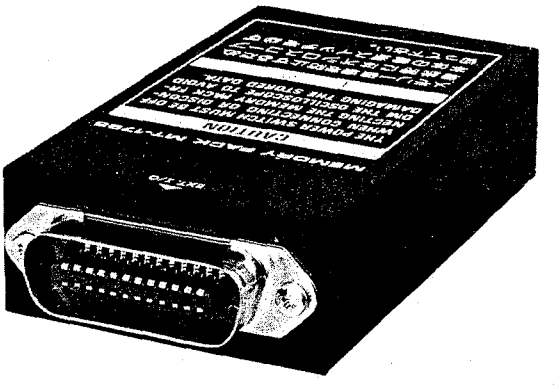
PROBE SELECTOR RU-1722
5 inputs × 2 channel
EXT × 3



PROBE SELECTOR RU-1723
10 inputs × 1 channel
EXT × 3



THERMAL PRINTER TP-1724
Serial transfer, dot matrix



MEMORY PACK MT-1725 CMOS RAM
1 k × 4 bit

MEMO:

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